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TECHNICAL MEMORANDUM

TO: **Bill Dana - DEQ Project Officer**

FROM: **Kevin Smith - E & E** KS

THRU: **John Montgomery - E & E Project Manager**

SUBJ.: **Continuous NAPL Extraction in TFA and Pilot Treatment System Modifications - McCormick and Baxter Creosoting Co. Site**

DATE: **June 4, 1998**

CC: **David Anderson - DEQ**

INTRODUCTION

As part of the ongoing effort to optimize NAPL extraction in support of the Remedial Action Objectives, E & E has prepared the following technical memorandum to propose site modifications that would attain the following goals:

1. Increased NAPL extraction efficiency via continuous (24 hours per day, 7 days per week) NAPL extraction in the TFA; and
2. Quantifying the amount of water and NAPL extracted from the TFA.

BACKGROUND

Recent operation and evaluation of the FWDA Treatment System has indicated that low extraction rates combined with a large NAPL settling tank allows for continuous NAPL extraction and yields a relatively accurate and reliable method for measuring and documenting the quantity of NAPL removed from the FWDA. The existing Pilot Treatment System in the TFA is not currently able to operate continuously and the measurement data is less accurate. Therefore, the proposed operation modifications for the Pilot Treatment System resemble operations currently employed in the FWDA Treatment System.

GOAL 1: CONTINUOUS NAPL EXTRACTION

The Pilot Treatment System is currently operating at a total flow rate of approximately 10 gallons per minute (gpm) for 40 hours per week (Monday through Friday, 8 hours per day) with pumping from three (3) TFA extraction wells (EW-1s, EW-4s, and EW-7s). Based on this operation schedule, the system treats approximately 24,000 gallons per week.

Currently, EW-1s, EW-4s, and EW-7s are pumping at approximately 2.5 gpm each, 40 hours/week, Monday through Friday (18,000 gallon per week or 3,600 gallons/day). To obtain continuous NAPL extraction from these TFA wells (i.e. pumping 7 days/week, 24 hours/day) while maintaining the current treatment system operation schedule of 40 hrs/wk, the total quantity of liquid pumped can not exceed the treatment system capacity of 24,000 gallon/week. Based on this treatment capacity, the calculated maximum allowable, continuous extraction pumping rate is 0.79 gpm per well.

In the FWDA, four extraction wells operating continuously (7 days/week, 24 hours/day) extracted an average of 674 gallons per day during the first quarter of 1998. This equates to an average continuous extraction rate of 0.12 gpm per well. The maximum daily extraction rate recorded in the FWDA was 974 gallons per day. This equates to a maximum continuous extraction rate of 0.17 gpm per well.

Pumping the three TFA wells continuously at rates similar to that in the FWDA (0.1 to 0.2 gpm) would result in extraction of 3,000 to 6,000 gallons per week which is well below the Pilot Treatment System's weekly treatment capacity (24,000 gallons/week). This analysis indicates that continuous NAPL extraction in the TFA, at similar extraction rates utilized in the FWDA, is possible within the limits of the current treatment capacity of the Pilot Treatment System.

Evaluation of the extraction efficiencies using low pumping rates in the FWDA indicates that these rates facilitate "slurping" of NAPL from the aquifer at rates close to the NAPL infiltration rate into the wells. In addition, the low pumping rates are advantageous in minimizing the quantity of water extracted from the aquifer and subsequently requiring treatment. Comparing the current extraction rates and efficiencies in the FWDA to those in the TFA and assuming the goal of pumping is to maximize NAPL extraction, it appears that the TFA is being significantly over-pumped. PTI established the pumping rates in the TFA to conduct "enhanced NAPL extraction" by combining water and NAPL extraction to create flow gradients toward the wells. Under certain site conditions, higher NAPL quantities can be generated with this pumping technique, however, the water to NAPL ratio is usually high, resulting in large quantities of water requiring treatment. Based on E & E's operation experience and past time-series sampling events (see the first and third quarter 1996 quarterly reports), it does not appear that "enhanced NAPL extraction" (in its current form) is effective in the TFA.

Therefore, to attain the goal of increased NAPL extraction efficiency in the TFA, E & E proposes to modify the pumping equipment and operation technique in the TFA to perform continuous, low flow NAPL extraction. E & E proposes to replace the electric centrifugal pumps in EW-4s and EW-7s with two (2) controllerless pneumatic pumps. The pump manufacturer, product evaluation, and selection has been presented in E & E's May 26, 1998, technical memorandum submitted under separate cover. E & E intends to adjust the extraction rates for all three TFA pneumatic pumps to 0.1 gpm per well when the new pumps are installed. All three pumps will be installed at the bottom of the wells to maximize DNAPL-only extraction.

GOAL 2: QUANTIFYING NAPL EXTRACTED FROM TFA

Any method used to quantify the amount of NAPL extracted contains a certain level of error due to the nature of the liquid. However, the amount of error can be minimized by certain operation techniques. The primary technique is to handle (pump) all NAPL gently to minimize agitation and emulsification, because once NAPL is vigorously mixed with water, it is difficult to return the mixture to its separate components that previously existed in the wells.

Gentle pumping requires positive displacement pumps such as pneumatic bladder or diaphragm pumps. In addition, extended holding times in tanks facilitates separation and accumulation of NAPL in a more easily measured manner as observed in the FWDA treatment system. E & E can utilize existing site equipment to create a NAPL holding/settling tank by making the following modifications:

- Remove Tank 1: This tank contains about 6 feet of settled material that has accumulated since startup of the system in 1993-4. The tank has never been cleaned. Once cleaned, this tank could be removed from the site.

- Utilize Tank 2 as the DNAPL Holding/Settling Tank: Water and NAPL from the TFA would be pumped into Tank 2. Drop-tubes installed to the bottom of the tank would prevent NAPL agitation while discharging into the tank. The tank is constructed in a manner that facilitates accumulation of DNAPL in a large rectangular sump. The tank will require leveling so that DNAPL thickness measurements can be converted to a DNAPL volume. To utilize Tank 2 in this manner, the tank will require minor cleaning to remove accumulated rust from the tank bottom which would impact the NAPL measurements.

- Gravity Flow from Tank 2 to DAF: Water and any LNAPL (if present) would gravity flow from Tank 2 into the DAF in the same manner that is currently used at Tank 1.

- Pump Water from DAF Directly to GAC: Currently water is pumped from the DAF to Tank 2, then pumped from Tank 2 to the GAC. By utilizing Tank 2 as the DNAPL storage tank, the current water flow scheme would not be possible. Therefore, treated water from the DAF will be pumped directly to the filters and GAC. This modification can be completed with existing pump and tank equipment. A float switch would need to be installed in the DAF water collection tank to operate the transfer pump automatically.

NAPL from the TFA will be measured in the bottom of Tank 2 in the same manner that NAPL is measured in the FWDA system. The low extraction rates from the TFA wells would not create an overflow problem at Tank 2 as long as consistent, reliable operation of the DAF occurs. At the proposed continuous extraction rates (approximately 0.1-0.2 gpm or approximately 150-300 gallons per day per well) the 20,000 gallon storage tank (Tank 2) would be able to collect water for approximately 20-45 days before an overflow condition would occur. In addition, the reduced extraction rates will reduce the required operation frequency of the Pilot Treatment System since it has the capacity to treat 10 gpm. Therefore, operation of the Pilot Treatment System may be reduced to only 1 to 2 eight-hour treatment operation days per week.